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ABSTRACT

The degree to which the concepts of educational technolgoy are penetrating into educational practice in Japan is surveyed. Educational technology is defined as a branch of study in which the results of engineering techniques, information science, the natural sciences, the behavioral sciences and human technology are used to promote efficiency in education. Following this, the uses of various devices such as overhead projectors and videotape recorders are sketched and some preliminary attempts to employ computers in education are reviewed. Lastly, information is provided about the number of schools utilizing programed instruction, auto-tutorials and other innovative approaches to instruction in various subjects. (PB)

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THE DEVELOPMENT OF EDUCATIONAL TECHNOLOGY IN JAPAN

by Takashi Sakamoto

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Introduction

Educational technology is an applied or practical study which aims at maximizing educational effects by "controlling" such relevant factors as educational purposes, educational content, teaching materials, educational methods, educational environment, conduct of students, behaviour of instructors and inter-relations between students and instructors. It is a branch of study in which the results of engineering techniques, information science, natural sciences, behavioural sciences and human technology are to be used to promote the efficiency of education. In practice, the school treasury and administration, the school and classroom management, and the work of instruction (intellectual education, moral education, counselling), all can make use of educational technology.

Sectors of educational technology

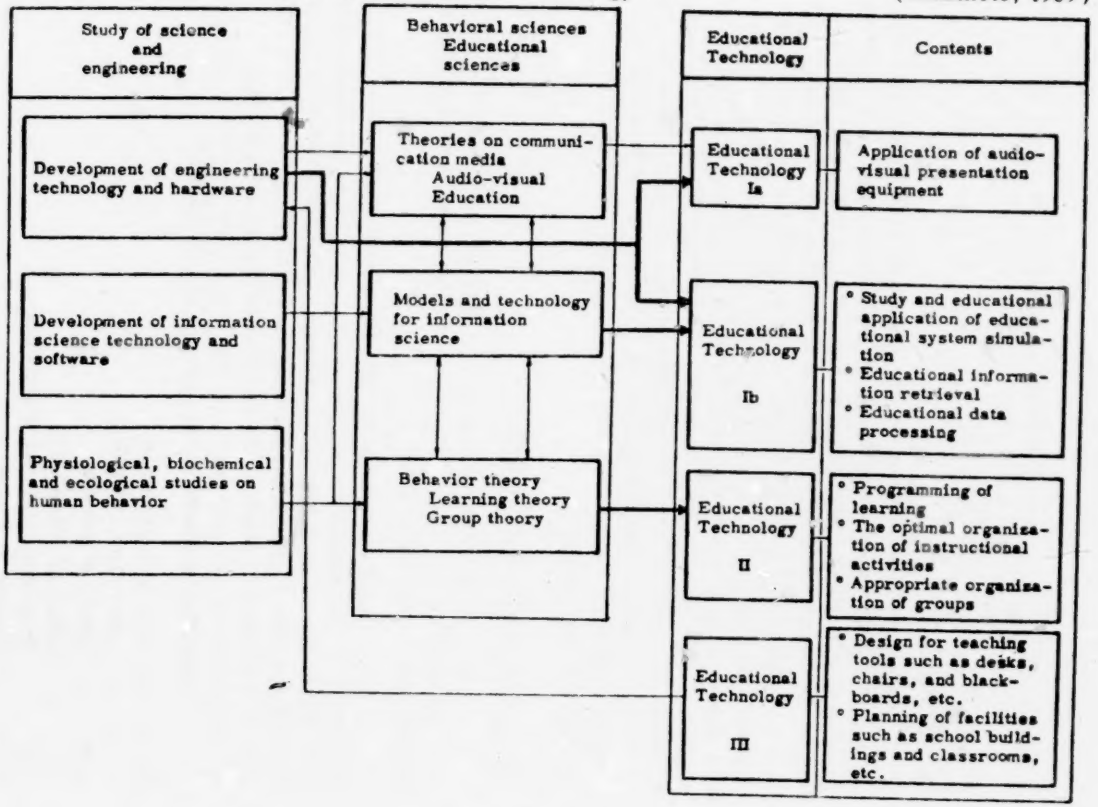
Fig. 1 is an attempt to show in a diagrammatic form the relationship between the various branches of study which are pertinent to educational technology.

Educational technology 1a and 1b (see Fig. 1) aim to promote efficiency in education by using the results of science and engineering. Two fields of research are included here: (a) applied study of devices and equipment for presenting teaching materials, and of training simulators; (b) applied study of the information science technology.

Abbreviations used in this article are as follows:

OHP = overhead projector
VTR = video-tape recorder
TM = teaching machine
LL = language laboratory
CAI = computer-assisted instruction
CRT = cathode ray tube
NC = numerical control
APT = automatically programmed tools
ET = educational technology
ASPAC = Asian and Pacific Council
OECD = Organization for Economic Co-operation and Development

Fig. 1 Branches for Studying Educational Technology (Sakamoto, 1969)


Study of science and engineering
Behavioral sciences Educational sciences
Educational Technology
Contents
Development of engineering technology and hardware
Development of information science technology and software
Physiological, biochemical and ecological studies on human behavior
Theories on communication media Audio-visual Education
Models and technology for information science
Behavior theory Learning theory Group thoory
Educational Technology Ia
Educational Technology Ib
Educational Technology II
Educational Technology III
Application of audio-visual presentation equipment
° Study and educational application of educational system simulation
° Educational information retrieval
° Educational data processing
° Programming of learning
° The optimal organization of instructional activities
° Appropriate organization of groups
° Design for teaching tools such as desks, chairs, and blackboards, etc.
° Planning of facilities such as school buildings and classrooms, etc.

Educational technology II (see Fig. 1) aims at developing teaching methods and effective arrangement of educational contents by using the theory of human behaviour. The application of learning theory for programming learning activities and the application of group behaviour theory for organizing learning groups belong to this category and are receiving considerable attention at present.

Educational technology III (see Fig. 1) is concerned with developing, by using our knowledge of human engineering, facilities, equipment and teaching tools and materials conducive to effective learning.

In the teaching-learning process, a variety of activities are called into play which determine the inter-relationships of teacher and learner. These inter-relationships can be seen as a three-way communication: from teacher to learner, from learner to teacher, and again from teacher to learner. The use of educational technology is designed to extend the functions of teacher and of learner in these complex relationships. Educational technologies might be classified (as in Fig.1) in terms of the specific functions that they seem best suited to extend.

Present state of educational technology in Japan

Table 1 shows the present state of use of various educational devices and equipment in all establishments in Japan in May 1969. The data are taken from a survey made by the Audio-visual Education Section of the Department of Social Education in the Ministry of Education. It would appear that the use of some devices and equipment in schools is not very extensive as yet. The same year, Tokyo Metropolitan Board of Education also examined the state of their use in all schools in Tokyo, which showed similar results. Table 2 shows the fields which the school teachers wished, and expected, to improve by means of educational technology. At every level, it is notable that the teaching-learning activities are singled out for priority in the application of educational technology.

In December 1969, Chiba Prefectural Education Centre also surveyed the state of use of educational devices and equipment. Based on the results of the survey, Fig. 2 shows the percentages of gain which, in the opinion of the teachers, were made in different aspects of learning by the application of educational technology in primary and lower secondary schools.

In recent years such media as overhead projectors (OHP), video-tape recorders (VTR), Response Analyzers and teaching machines have been used more and more in the schools of Japan. The Primary and Lower Secondary Education Bureau in the Ministry of Education started an experiment in 22 lower secondary schools in 1968 to study the conditions concerning the effective use of a variety of educational equipment

Table 1. Present state of use of various devices, in percentages of total number of institutions (May, 1969)

		Kinder-garten	Elemen-tary Schools	Lower Elemen-tary Schools	Upper Secondary Schools (public)	Upper Secondary Schools (private)	Special Schools	Citizens Public Halls
Total number of institutions		3 862	24 497	10 580	3 272	1 145	365	7 648
16 mm motion picture projectors		1.5	36.9	35.1	80.1	76.0	49.9	50.4
Slide projectors		56.7	85.2	85.2	93.9	91.7	78.6	32.9
8 mm motion picture projectors	double	5.1	27.6	31.5	74.4	75.4	33.4	15.3
	single	6.9	31.1	31.9			35.1	11.0
Television		78.9	91.1	81.2	70.0	78.5	86.0	30.0
	colour	5.1	2.6	1.7			16.2	1.5
Magnetic recorders	tape	60.4	87.8	90.1	94.2	92.8	81.1	46.2
	sheet	0.6	9.4	15.6			15.3	0.7
Overhead projectors		0.3	14.6	25.7	61.6	45.2	32.9	1.1
Video-tape recorders		1.5	3.3	6.4	16.4	29.7	6.3	0.9
Language laboratories				3.2	3.6	18.4		
8 mm cine cameras					67.1	66.1		

in classroom instruction. This was extended to another 22 primary schools in 1969. These studies have served to set in motion an accelerating movement in various regions in Japan.

A number of schools use OHP, TV, simple manual teaching machines (TM), Response Analyzers and their various combinations. In other words, teachers are trying to expand their instructional functions by means of man-machine systems (combinations of teacher and devices or equipment) and by means of automatic educational devices and equipment systems.

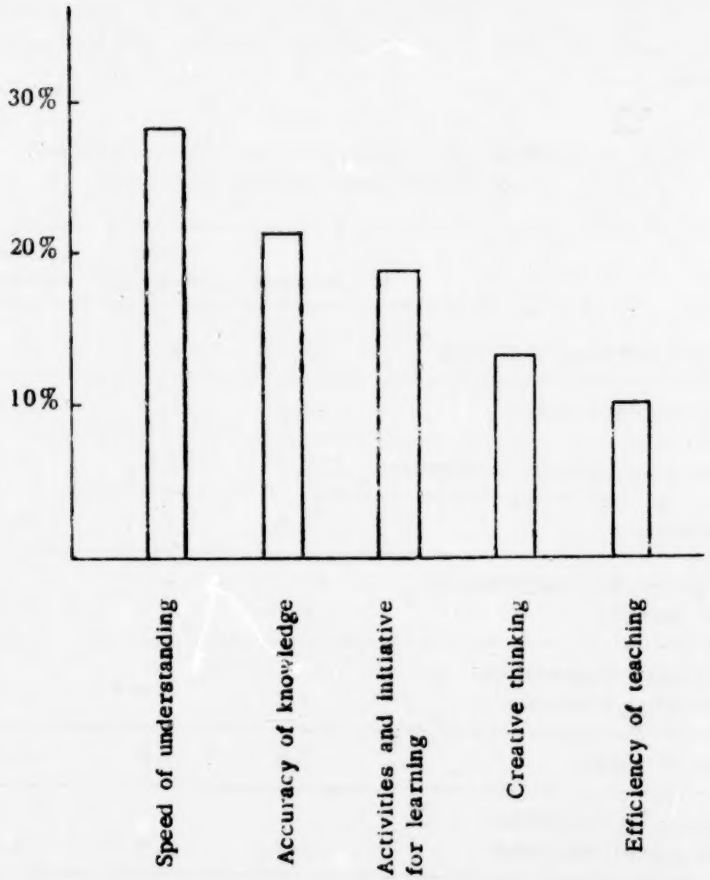
In Japan, simple manual TMs, especially those which use a cassette-type recorder or a sheet-type recorder, are most widely in use in schools, while many teachers produce also paper "machines" such as programmed sheets or texts (which are inexpensive) to be used individually by each learner. A few teachers use various types of automatic TMs in the class, but these are not yet in general use. Most of the best teachers use combinations of OHP, TV and Response Analyzer.

Table 2. Teacher expectations for improving education by means of educational technology

	Primary	Lower Secondary	Upper Secondary
Teaching-learning activities	33.7	32.1	27.5
School administration	20.4	15.0	10.6
School and classroom management	12.0	12.0	5.5
Counselling	7.6	9.7	10.3
Data processing (attendance and marks)	6.7	8.7	11.7
Curriculum organization (including time-table)	4.9	9.7	11.2
Health of pupils	7.6	5.8	6.8
Guidance for vocational and higher education	1.0	9.4	13.1

We found combinations such as OHP and Response Analyzer effective in teaching social studies in primary schools. The same teacher taught the same contents to two groups of pupils of the same level of ability during successive 20 school hours by means of two different educational methods - namely the experimental class by using the OHP, slide projector and Response Analyzer, and the other by means of conventional instruction. Pupils in the experimental class gained better scores in a shorter time.

Fig. 2. Educational aspects where the effectiveness of instruction was increased by means of educational technology (Chiba Survey, 1971)



The use of computers in education is still limited. Though Japan has a great number of computers, they are hardly used in educational fields except for data processing in educational research and experiments. About ten universities use a computer to process the results of the entrance examination. Some big preparatory schools for universities also use them to process the results of tests and for the guidance and counselling of students for admission to suitable universities.

A few universities and research institutes are studying the use of computer-assisted instruction both in school education and for training within industries. The lower secondary school attached to Kagawa University introduced CAI for classroom education in 1965: this system, which was called KANECOM 1, was intended only to present linear programmes according to the students' responses to the Response Analyzer in the class. In 1969, KANECOM 2 was developed, which was able to skip some steps of a programme and to present moving images by means of VTR. In 1968, this school set up a CAI system which used NEAC-1210 (500 watts) and later NEAC-M 4 (8 kw) with two terminals. Each of them has two slide projectors, one tele-typewriter and one audio tape recorder. Various kinds of learning programmes are now being developed.

The Centre for the Ability Development Engineering also has a CAI system (NEAC 2200-50) with two terminals, each of which has a random access audio and visual equipment and a keyboard. Programmes for training within industries are now being produced in the Centre.

In June 1971, the Association for the Machinery Promotion completed a CAI development project for industrial education, supported by the Ministry of International Trade and Industry and in which big electric manufacturing companies co-operated. This CAI system has such components as HITAC-10 (32 kw) and 30 terminals, 8 of them having a CRT display (4 colours in character mode), a keyboard, a random access audio equipment and a random access film projector, and 22 of them having a tele-typewriter and a random access film projector. The system is able to teach 30 different subjects to 30 different learners individually and simultaneously. Six programmes are now going to be produced - COBOL, FORTRAN, Introduction to computer, NC Machine Tool, APT (Automatically Programmed Tools) and Technique for Repairing Colour TV. The development of this system is bound to have a far-reaching influence on the future development of educational technology in Japan.

In 1971, the Research Fund for Science in the Ministry of Education provided 40 million Yen to a research group to study the use of computers in education. The research group is composed of many researchers from ICU, Tokyo Institute of Technology, and Tokyo University of Education.

Programmed instruction and other methods

In Japan, since the beginning of 1960s, leading teachers have developed programmes for programmed learning, which the Research Group for the Science of Learning has collected. Table 3 shows their distribution by subject and school level.

Some schools also are experimenting with team teaching and auto-tutorial methods, and many associations and groups of teachers and researchers are experimenting with specific devices or their combinations. These separate groups are gradually integrating into one new Educational Technology Group. A survey in the schools where these experiments are being tried out shows the wide range of subjects being covered: not only mathematics and science but also languages and social studies.

Conclusion

The concepts of educational technology are now penetrating into the educational fields in Japan. Since 1970, many publications on ET have appeared, which include three different lecture series on ET, several books and one dictionary. There are also two monthly general journals - Research for Educational Technology and Contemporary Educational Technology - in addition to monthly journals which deal with specific aspects (e.g. Broadcasting Education, Audio-visual Education, Audio-visual Technology, School Sciences). The number of publications on educational technology is expected to increase rapidly in the near future.

Many seminars and meetings have dealt with topics on ET. The influence of computers in education was discussed at the annual congress of the Association for Educational Psychology in 1970. The Society of Electronic Telecommunication holds monthly conferences where reports of research on educational technology are discussed. Three international seminars were held in Japan in recent years: Unesco's Workshop on Experimental Project on Programmed Instruction in Asia; ASPAC's Seminar for Audio-visual Education; and OECD's International Seminar on the Uses of Computers in Education.

In 1971, the Ministry of Education has established four Centres for Educational Technology in four university colleges of education: the Tokyo Gakugei University, and the Hokkaido, Aichi and Fukuoka Colleges of Education.

Table 3. Numbers of programmes by subject and school level

	Primary Schools								Lower Secondary Schools					Higher secondary schools, colleges and universities			
Grades:	I	II	III	IV	V	VI	Others	Total	I	II	III	Others	Total				Total
Japanese	11	22	84	47	40	30	20	254	11	7	7	11	36	35	-	35	325
Social studies	3	9	10	24	30	19	5	100	12	7	3	12	34	4	-	4	138
Mathematics	167	74	178	124	127	71	124	865	259	206	115	18	598	169	94	263	1 726
Science	40	43	35	66	64	69	8	325	53	46	35	22	156	148	96	244	725
Music, art, health and physic	2	-	1	3	2	3	-	11	3	3	2	8	16	-	1	1	28
English	-	-	-	-	-	-	-	-	16	13	8	13	50	8	24	32	82
Vocational education	-	-	-	-	2	4	-	6	16	6	7	18	47	274	331	605	658
Computers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	35	35
Educational psychology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3
Total	223	148	308	264	265	196	157	1 561	370	288	177	102	937	638	584	1222	3 720